Amendments to the Specification

Replace the paragraph beginning on page 5, line 3 with the following:

By design, a disc drive typically has a ~~discreet~~ discrete threshold level of resistance to withstand rotationally induced noise and instability, below which the servo system is not impaired. Also, a fixed range of load forces must be maintained on the read/write head to ensure proper fly height for data exchange. The operating performance of the disc drive servo system is affected by mechanical factors beyond the effects of mechanically induced read/write head oscillation from disc surface anomalies. Errors are traceable to disc pack imbalance and RVA noise sources. Even with improved approaches to the generation of position error signals in the disc drive servo system, the ability of the system to deal with such issues is finite. The limits of the servo system capability to reliably control the position of the read/write head relative to the data track must not be consumed by the noise present in the HDA resulting from the assembly process. Consumption of the available margin by the assembly process leaves no margin in the system to accommodate changes in the disc drive attributes over the life of the product. An inability to accommodate changes in the disc drive attributes leads to field failures and an overall loss in product reliability, a detrimental impact to product market position.

Replace the paragraph beginning on page 5, line 27 with the following:

The present invention is directed to a computer directed head stack assembly installation system with an installation software program having installation software program steps stored on recordable media directing the controlling a sequence of head stack installation assembly steps executed by a head stack assembly installation station installing a

head stack assembly into a basedeck assembly forming a head disc assembly of a disc drive. The installation software program directs a robotic assembly in a sequence of assembly steps directing the robotic assembly to pick and place the head stack assembly into the basedeck. During the placement operation, the installation software program monitors compliance of the placement operation ~~to~~ with respect to mechanical resistance encountered by the head stack assembly engaging the basedeck. The mechanical resistance is checked for performance characteristics against a dynamic force threshold F determined by the equation [$F = (f(p) +/- x)$] and against the dynamic slope V determined by the equation [$V = (f_n - f_{n-1})/(p_n - p_{n-1})$]. Upon successful installation of the head stack assembly into the basedeck forming the head disc assembly, the head disc assembly is released from the head stack assembly installation station.

Replace the paragraph beginning on page 7, line 13 with the following:

FIG. 14 is a diagram showing ~~an~~ a family of empirically derived mechanical resistance thresholds.

Replace the paragraph beginning on page 8, line 28 with the following:

To provide the requisite electrical conduction paths between the read/write heads 138 and disc drive read/write circuitry (not shown), read/write head wires (not shown) are affixed to a read/write flex circuit 150. Next the read/write flex 150 is routed from the load arms 136 along the actuator arms 134 and into a flex circuit containment channel 152 and on to a flex connector body 154. The flex connector body 154 supports the flex circuit 150 during passage of the read/write flex circuit 150 through the basedeck 102 and into electrical communication <u>with</u> a disc drive printed circuit board assembly (PCBA) (not shown)

mounted to the underside of the basedeck 102. The flex circuit containment channel 152 also supports read/write signal circuitry 156 used to condition read/write signals passed between the read/write circuitry (not shown) and the read/write heads 138. The disc drive PCBA provides the disc drive read/write circuitry, which controls the operation of the heads 138, as well as other interface and control circuitry for the disc drive 100.

Replace the paragraph beginning on page 9, line 9 with the following:

To maintain the sealed internal environment for the disc drive 100, a seal gasket 158 is molded on to the top cover 106. Top cover 106 has a multitude of gasket attachment apertures 160 through[[,]] which gasket material flows during the gasket molding process. A continuum of symmetrically formed gasket material is disposed on both the top and bottom surfaces of the top cover 106 and injected through the apertures 160. During the cure process, the gasket material injected into the gasket attachment apertures 160 bonds the portion of the seal gasket adjacent the top surface of the top cover 106 to the portion of the seal gasket adjacent the bottom portion of the top cover 106, thereby sealing the gasket attachment apertures 160 and forming the seal gasket 158. A gasket material found to be useful for this application is "Fluorel" by the 3M Company, and more specifically, 3M "Fluorel", FE- 5621Q.

Replace the paragraph beginning on page 10, line 4 with the following:

FIG. 2 shows a basedeck assembly 168 to include the basedeck 102, the disc pack assembly ~~168~~ <u>164</u>, the air filter 166, a bottom pole piece 170 supporting a rare earth magnet 172 and a head stack assembly post 174 supporting a removably attached tolerance ring 176. The bottom pole piece 170, with the rare earth magnet 172, together with the top pole pieces

148, supporting a second rare earth magnet (not shown), form the magnet assembly 146, and together with the actuator coil 144, collectively form the VCM 142. The basedeck assembly 168, together with an installed HSA 128, magnet assembly 146 and top cover 106, combine ~~combined~~ to form the HDA 162 of FIG. 1.

Replace the paragraph beginning on page 10, line 12 with the following:

FIG. 3 shows the flex connector body 154 with the attached flex circuit 150 supporting a machine-readable head stack assembly serial number 178. In a preferred embodiment machine-readable head stack assembly serial number 178 is a barcode but could also be characters capable of being optically recognized using optical character recognition software (OCR) or other comparable coding methodologies. The serial number 178 represents the physical characteristics for a particular HSA 128 that includes information such as the number and type of read/write heads 138 the HSA 128 contains, the type of bearing assembly 130, or the type of actuator coil 144 supported by the HSA 128.

Replace the paragraph beginning on page 11, line 5 with the following:

To initiate the process of installing the HSA 128 onto the tolerance ring 176, an operator completes a series of inspection and preparation steps. The operator first checks the flex connections (not separately shown) and the bearing assembly 130 to assure the HSA 128 is intact. Next the operator manually removes a shipping constraint (not shown), used to protect the HSA 128 during shipment, and adjusts the head stack assembly installation comb ~~198~~ to complete the preparation and inspection steps.

Replace the paragraph beginning on page 14, line 17 with the following:

FIG. 8 shows a gripper 254 of the end effector 232. Included in the gripper 254 ~~is a~~ are radially disposed positionable gripper sections 258 linked to operate in unison and attached to a gripper housing 260. Each gripper section 258 supports a gripper finger 262 that is shaped to conform to the slope of the external surface of the beveled pick and place member 132. Each of the radially disposed positionable gripper sections 258 is coupled to the potentiometer 248 by a potentiometer coupling arm 264.

Replace the paragraph beginning on page 14, line 24 with the following:

A push pad (also referred to as a "centering post") 266 is attached to the gripper housing 260 and ~~circumvented~~ circumscribed by the radially disposed positionable gripper sections 258. The radially disposed positionable gripper sections 258 move toward the push pad 266 contacting beveled pick and place member 132 to align the HSA 128 to the end effector assembly 232. Alignment of the HSA 128 to the end effector assembly 232 includes alignment of the top inner race 182 to the push pad 266. During the installation process the gripper fingers 262 remain in contact with the beveled pick and place member 132 until contact is established between the HSA 128 and the head stack assembly post 174. Upon measurement of initial contact between the HSA 128 and the HDA 162, and reporting of that measured contact to the computer 206 by the load cell 252, the radially disposed positionable gripper sections 258 disengage contact with the beveled pick and place member 132. The push pad 266 remains in contact with the inner race of the bearing assembly 130 to transfer the compressive load delivered by the end effector assembly 232 to the HSA 128 during the process of pressing the HSA 128 onto the tolerance ring 176 of the HDA 162. Retracting the radially disposed positionable gripper sections 258 from contact with the beveled pick and

place member 132 during the process of pressing the HSA 128 into position reduces the chances of the bearing 184 being damaged during installation process.

Replace the paragraph beginning on page 15, line 11 with the following:

FIG. 9 shows the interaction between the gripper fingers 262, the push pad 266 and the beveled pick and place member 132. The gripper fingers 262 provide a slope surface 268 that conforms to the slope of the outer surface of the beveled pick and place member 132 while the push pad 266 provides a shouldered outer diameter 270 that is inserted into the inner race of the pick and place member 132. When activated to engage the HSA 128, the radially disposed positionable gripper sections 258 contact the outer surface of the bevel pick and place member 132 and align the HSA 128 to the end effector assembly 232 by positioning the inner surface of the pick and place member ~~232~~ 132 into contact with the outer diameter 270 of the push pad 266.

Replace the paragraph beginning on page 15, line 21 with the following:

FIG. 10 shows a central processing unit 272 (CPU) electronically communicating with recordable media 274. The recordable media 274 holds an installation software program (not separately shown) that has installation software program steps to carry out the assembly herein described. The term electronically communicating or in electronic communication does not necessarily mean that the two devices engaging in the communication are physically connected. The term includes devices that are physically connected and devices that are electronically connected via networking links such as infrared communication, radio-frequency communication or through the internet via satellite communication. For example, the recordable media 274 may located in one country, for example the United States, and the

CPU 272 could be located in a different country, for example Ireland. The two devices, the CPU 272 and the recordable media 274, are each elements of the head stack assembly installation system 200, dependent on each other for the functioning of the head stack assembly installation system 200, but neither is in direct physical contact with the other. They are however[[,]] linked, one to the other, electronically as portions of the head stack assembly installation station 200. FIG. 10 also shows the central processing unit 272 in electronic communication with a volatile memory 276 (also referred to herewithin as random access memory or RAM), a head stack assembly serial number data base 278 and a head disc assembly serial number data base 280.

Replace the paragraph beginning on page 16, line 9 with the following:

The central processing unit 272 electronically communicates with the recordable media 274 to upload the installation software program into the RAM 276 prior to execution of the installation process. During the installation process the installation software operates out of the RAM 276. In addition to containing an active version of the installation software program the RAM 276 also temporarily stores information communicated to the computer 206 from the communication interface electronics assembly 246. The stored information includes a head stack present signal (not shown), detected by the head stack digital sensor 228, a head disc present signal (not shown), detected by the head disc assembly present digital sensor 230, a value (not shown) representing the head stack assembly serial number 178, provided by the head stack assembly scanner head 224 and a value (not shown) presenting the head disc assembly serial number 180, provided by the head disc assembly scanner head 226. During operation of the head stack assembly installation system 200, additional data regarding position and force parameters encountered by the HSA 128 during

the installation process, as well as position data for the radially disposed positionable gripper sections 258, the vertical slide assembly 234 and the horizontal slide assembly 236, are gathered and written to the RAM 276 on a real-time basis. The position of the horizontal slide assembly 236 is monitored and reported to the communication interface electronics 246 by the linear horizontal slide digital sensor 240, the position of the vertical slide assembly 234 is monitored and reported to the communication interface electronics 246 by the linear vertical slide digital sensor 238, while position data for the gripper sections 258 is continually monitored by the radial displacement potentiometer 248. The position and force parameter measurements encountered by the HSA 128 while being pressed onto the tolerance ring 176 are made and supplied to the RAM 267 by the linear variable differential transformer 250 and the load cell 252 respectively.

Replace the paragraph beginning on page 17, line 21 with the following:

FIG. 11 shows a main process decision flow 300 utilized by the installation software program to grip the HSA 128 in preparation for installation of the HSA 128 into the HDA 164 of the disc drive 100. Once a start step 302, of the installation software program steps is initialized, three decision steps follow. The first decision step, HDA in position 304, verify the presence of the HDA 164 within the installation position 212 of the main plate 208. The second decision step, HSA positioned in the nest 306, verifies the presence of HSA 128 in the nesting position ~~212~~ 210 of the main plate 208 and the third decision step, HSA serial number entered 308, verifies the presence of the serial number 178 within the RAM 276.

Replace the paragraph beginning on page 19, line 1 with the following:

FIG. 13 shows the analyze force and position data - decision flow 340 of the

installation software program is utilized by the installation software program to measure and analyze forces and positions encountered by the HSA 128 while engaging the tolerance ring 176, as the robotic assembly presses the HSA 128 into the basedeck assembly 168. A start step 342 is the first installation software program step of the analyze force and position data - decision flow 340. The software installation program incorporates a force to distance ratio equation 344 to monitor installation of the HSA 128 onto the tolerance ring. During the installation process, process parameter measurements representing force and distance are gathered by the head stack installation tool 204 (of FIG. 7) and electronically communicated to the computer 206 (of figure 7). The computer 206 manipulates the measurements by converting the measurements into values and substituting those values into equation 344. The resulting calculated value, a slope, is compared to predetermined value dynamic slope V of decision step 348.

Replace the paragraph beginning on page 19, line 15 with the following:

Turning to FIG. 14, the predetermined value V is empirically derived for forces typically encountered by the HSA 128 while being pressed onto the tolerance ring 176 at specific increments of distance encountered by the HSA 128 while traveled along the tolerance ring 176 and found to have a maximum value of 600, 358. The software also monitors mechanical resistance ~~encounter~~ encountered during the process at time intervals of about every 50 milliseconds over the distance traveled by the HSA 128 while traveled along the tolerance ring 176. Empirically gathered mechanical resistance data yielded a mechanical resistance as a function of position (f(p)) curve 360. The mechanical resistance as a function of position curve 360 was arrived at through normal curve fitting techniques, relating the mechanical resistance encountered by the HSA 128 while being pressed onto the

tolerance ring 176 to a point representing the distance covered by the head stack assembly at the point in time the mechanical resistance was encountered. A tolerance of about plus and minus 5% of the mechanical resistance encountered by the HSA 128 in any region of the tolerance ring 176 was elected and applied to the force curve resulting in a family of values representing dynamic force thresholds 362 against which actual measured process data can be dynamically compared. Forces encountered that fall outside the dynamic, either insufficient or excessive, trigger the head stack assembly installation station to abort the process.

Replace the paragraph beginning on page 20, line 3 with the following:

Returning to FIG. 13, the equation (F = f(p) +/- x) and ~~slop~~ slope < V of 348 is interpreted to mean; should the force (F) measured as encountered by the HSA 128 at a position (p) while being pressed onto the tolerance ring 176 fall outside the empirically derived force as a function of position (f(p)) curve, plus or minus (x), about 5% of the force empirically found to be encountered at position (p) along the tolerance ring 176 during the mating process, the process will be aborted. And, should the force (F) measured as encountered by the HSA 128 at a position (p) while being pressed onto the tolerance ring 176 fall within the empirically derived mechanical resistance as a function of position (f(p)) curve 360 (of FIG. 14), plus or minus (x), about 5% of the mechanical resistance empirically found to be encountered at position (p) along the tolerance ring 176 during the mating process, but the ~~slop~~ slope exceeds a predetermined value, empirically found to be about 600, the process will be aborted. Or, if the resultant calculated value falls outside the predetermined value V, the installation software program instructs the head stack installation tool 204 to abort the process, return the HSA 128 to the nest position 210 (of FIG. 7), and

display a message on the display 334 reporting the status of the process and instructing the operator to remove the HSA 128 from the nest position ~~112~~ 210, place the next HSA 128 into the nest position ~~112~~ 210, and restart the process at process step 300. However, typically the software installation program remains in decision loops until the installation software program receives, from either of the installation software program steps 346 or 348, an affirmative response.

Replace the paragraph beginning on page 21, line 12 with the following:

In accordance with a preferred embodiment, the present invention provides a method for installing a head stack assembly into a basedeck assembly to form a head disc assembly of a disc drive. A method employs a head stack assembly installation system (such as 200) with a head stack installation tool (such as 204) electronically communicating with a computer (such as 206) that has an active installation software program directing and controlling process steps enacted by head stack installation tool to install a head stack assembly (such as 128) into a head disc assembly of a disc drive (such as 100). The head stack installation tool provides a nesting position (such as 210) for aligning ~~in staging~~ a head stack assembly prior to installation into the head disc assembly, an installation position (such as 212) for locating ~~in securing~~ the head disc assembly while awaiting installation of the head stack assembly, a robotic assembly (such as 214) the robotic assembly includes an end effector assembly (such as 232) supported by a vertical slide assembly (such as 234), which is in turn supported by a horizontal slide assembly (such as 236) that attaches to a main plate (such as 208). A measurement assembly made up of a communications interface electronics assembly (such as 246) electronically communicating with a radial displacement potentiometer (such as 248), a linear variable differential transformer (such as 250), and a

load cell (such as 252). The robotic assembly picks and places the head stack assembly into the head disc assembly and the measurement assembly collects and communicates process position and force parameters to the computer for use by the computer in calculating distance and force data. The active installation software program directs and controls enactment of process steps followed by the head stack installation tool by directing the computer to execute installation software program steps based on the position and force data calculated by the computer.